

Climate Resilience Zoning Task Force
City of Cambridge, Massachusetts
Summary of Meeting #13
February 13, 2020

Task Force members present

1. Jason Alves, East Cambridge Business Association
2. Louis Bacci Jr., Laborers Local 151/East Cambridge/Planning Board
3. John Bolduc, Environmental Planner
4. Iram Farooq, Assistant City Manager for Community Development
5. Tom Lucey, Harvard University
6. Mike Owu, MITIMCo.
7. Brian Goldberg – MIT Office of Sustainability
8. Kathy Watkins, City Engineer/Assistant Commissioner
9. Nancy Donahue – Cambridge Chamber of Commerce
10. Jim Newman – Resilience Consultant, Linnaean Solutions
11. Tom Chase – Energy and Resilience Consultant – New Ecology
12. Ted Cohen – North Cambridge/Planning Board

Project staff and facilitation team members present

1. Jeff Roberts, Director of Zoning and Development, City of Cambridge
2. Sarah Scott, Associate Zoning Planner, City of Cambridge
3. Daniel Messplay, Senior Zoning Manager, City of Cambridge
4. Drew Kane, Land Use Planner, City of Cambridge
5. Pat Field, Consensus Building Institute facilitator
6. Florangel Suero, Consensus Building Institute facilitator
7. Indrani Ghosh, Weston and Sampson
8. Bella Purdy, Kleinfelder
9. Stephanie Hsia, Reed Hilderbrand

Meeting Materials

For more details of the analysis summarized below, see the meeting materials available at <https://www.cambridgema.gov/CDD/Projects/Zoning/climateresiliencezoning> .

Review of Cool Factor and Key Questions and Responses from Last Meeting

Kathy Watkins, City Engineer and Assistant Commissioner for the City of Cambridge, started the meeting with a presentation that addressed the questions, comments, and concerns raised about the Cool Factor framework raised in the previous CRZTF meeting.

Introduction

Ms. Watkins gave a brief overview of the intentions the City had for the Cool Factor which informed how the framework operates. Ms. Watkins clarified that the Cool Factor was created to address urban heat islands and rising temperatures. Strategies included in the Cool Factor can also address stormwater management, but stormwater management is subject to a separate set of more prescriptive standards. The Cool Factor concept is to create a performance standard specifically for the issue of cooling, although the design approaches used to meet the Cool Factor might also help to meet other standards and promote other City goals.

Ms. Watkins also clarified that the Cool Factor was created to be inclusive of a range of different strategies because the City wants to encourage a diversity of strategies to account for the difference in the effectiveness of different strategies and to create flexibility for landowners deciding which strategies to apply on their parcels. The Cool Factor is evidence-based with performance-driven standards based on available research.

Cambridge Cool Factor vs. Seattle Green Factor vs. Somerville Green Factor

Ms. Watkins then moved on to compare the proposed Cambridge Cool Factor to the Seattle Green Factor and the Somerville Green Factor, which had been a key point of discussion for participants at the previous CRZTF meeting.

Ms. Watkins explained that the team reviewed the Seattle and Somerville Green Factor systems when developing the Cool Factor, and there is overlap in many areas including tree preservation, tree planting, vegetation and planted areas, and green roofs. However, a small number of strategies were included in the other cities' Green Factors but not included in the Cool Factor because they did not relate to overall cooling performance. And some additional strategies were included in the Cool Factor that improve cooling performance that weren't included in the various Green Factors. *(See presentation for more detailed overview.)*

She suggested that an Innovation Bonus could be considered as part of the Cool Factor framework to account for strategies that can demonstrate a specific cooling benefit but are not anticipated by this framework.

The following strategies were addressed:

- *Pervious Paving* - there is not enough evidence to suggest it aids significantly in cooling, although it could help to meet stormwater management standards (in some cases current zoning requires or encourages this).
- *Structural Soil Systems* - trees and green areas are already included in the Cool Factor, but structural soil is not given extra weight because it would be “double counting” the benefit. Soil quality/viability could be considered as part of “prerequisites” for earning Cool Factor credit.
- *Rain Gardens, Bioswales, and Stormwater Planters* – would earn Cool Factor credit under the general Green Spaces category, and would also help to meet prescriptive stormwater management standards.
- *Water features* – Cooling benefits are unclear, and not the most relevant for the scale within the City of Cambridge (too dense for pools or artificial ponds, etc.).
- *Native plant species and food cultivation* - all kinds of plants are already included in the Cool Factor for trees/green area points. Using native species as a climate change mitigation strategy is complicated by the fact that as climate changes occurs, the type of plants that would be most beneficial to Cambridge could also change.
- *De-paved lot area* - if a paved area is transformed into an area with grass turf or other plantings it would improve the Cool Factor score, but there is no additional credit given for simply removing asphalt because the effect would benefit sites for having worse existing conditions.
- *Innovation score* - Created to account for strategies that we don’t know of right now, or that research in the future proves is an effective strategy for cooling. Ultimately, it is a way to create flexibility and acknowledge that not everything can be defined clearly in this process. A process would need to be created to evaluate the validity of strategies proposed for this bonus.

Questions and Answers: *Responses from City staff/project team are italicized.*

- How do you envision this going into effect, since this is a zoning task force? Is the idea that the city would just adopt the Cool Factor framework as zoning? Doing that would be so specific that it would take up a lot of time. Or is it that a Cool Factor is going to be applied as a series of regulations rather than zoning policy?
 - *The Cool Factor concept is designed to be a development standard, but we have not yet discussed how it would be implemented through zoning requirements. Options could include integrating into the base zoning, or it could be part of project review. The first step is to figure out what we are trying to strive for with the Cool Factor. Then, we will have a more in-depth conversation in our meetings in March; we will dive into the range of ways to use it.*

- Would decomposed ceramic and new paving products that are coming out earn points? More pervious material?
 - *Any of those would earn points in the Cool Factor only if they have high SRI scores.*
- I know there are certain things that we don't want to double count, but wouldn't it be best to incentivize certain things like de-paving? De-paving seems like something that should be reconsidered for additional points in order to incentivize it.
 - *We thought about this when formulating the Cool Factor and concluded that de-paving would affect the scoring too much based on the existing site. If there was an existing site that had a lot of paving, then it would get a lot of benefits because it would get the green and the de-paving benefit. This approach is more focused on the final outcome or output.*
- Could you speak to what lessons have been learned from the experiences of Somerville and Seattle in applying their Green Factors? Specifically, what are things that worked out differently than they imagined, mistakes to avoid, things that their municipalities would do differently, etc.?
 - *Somerville just implemented its Green Factor so there are no lessons to be learned from its implementation yet. On the other hand, Seattle has a significant number of examples and analyses on their website that we went through. However, a number of the examples tended to be more suburban than ours, so we thought some of the examples presented there might not be directly relevant to Cambridge.*

Stormwater management

Ms. Watkins spoke briefly about stormwater management requirements and their relevance. She reminded participants that there are a number of prescriptive stormwater management requirements within the City of Cambridge that need to be revised. To illustrate she shared that the currently listed estimated water discharge of a "large storm" is smaller than the actual discharge of present-day small storms given the changing climate. She added that stormwater management requirements do take into account phosphorous and other nutrients, and as a result encourage green infrastructure for water quality and water management outside of the cooling benefit of such green infrastructure. If a Cool Factor standard were implemented, then together with the stormwater management requirements it would help to encourage green infrastructure that could earn credit toward meeting both.

Vegetated walls

Ms. Watkins explained that vegetated walls were not included in the City's original plan because their cooling effectiveness in Cambridge's climate is unclear, though these walls might

work for cooling in certain areas of the City. Another concern is that they require extensive maintenance, and if there is a likelihood they will fail, it is difficult to assign a long-term benefit.

Ms. Watkins then explained that under the original Cool Factor concept, vegetated walls could be considered for an Innovation Bonus, but they wanted more feedback from the Task Force and members of the public on this issue. A member noted that a benefit to vegetated walls would be that they do not take up lot area in a way that other strategies do, so we should consider incentivizing it because of that.

Questions and Answers: *Responses from City staff/project team are italicized.*

- Vegetated walls are really water-intensive to maintain. Nonetheless, they are fantastic for cooling in some interesting ways.
 - *We had reservations about how vegetated walls could be properly inspected to ensure their success and proper maintenance over time (e.g., how could we get assurance that a vegetated wall could survive through winter?).*
- But wouldn't that be true for anything that can be grown, like grass regardless of whether vertical or horizontal?
 - *There is a track record of success for lawns, green roofs, trees, etc. in this environment. In the Cambridge context, we don't have a substantial-enough record to say that vegetated walls are likely to be successful. It would be risky to include them because of this.*
- Could concerns about vegetated walls be addressed by the species planted?
 - *We want to maintain flexibility, so we'd prefer not to have to get too prescriptive.*
- The intensity of maintenance is so high on vegetated facades, not only are there high installation costs, there are drip irrigation systems that have to be drained in a timely manner which are prone to breaking in the wintertime. Moreover, the range of plants that would be appropriate for Cambridge's climate is more limited than in cities like Seattle. Finally, the methodology for quantifying the cooling benefit of vegetated walls is not readily available.
- There are examples of vegetated walls in the City: Harvard walls are covered in Ivy, there are homes with greenscreens. So, there is some experience within Cambridge of dealing with vegetated walls.
- *I hear a lot of support for including vegetated walls in the point system, so let me ask this question on the flip side: is there anyone here that feels that this shouldn't be included?*
 - The issue of not being able to quantify the benefit is a significant one.
 - The main benefit to cooling from vegetated walls is probably derived from transpiration as well as albedo, so scoring is not impossible.

- Where do awnings and sunscreens and other things that provide shade fit in here?
 - *They are included in the Cool Factor scoring system within the first category on the spreadsheet (“shade structures”).*

Cool Roofs

Kathy reminded meeting participants that because cool (high-SRI) roofs provide significant cooling benefits and are easy to install, they are prerequisites for the cool factor. She added that cool roofs are not counted for points within the framework because their cooling benefit is so substantial that it would be really easy to earn all the necessary points from just having a cool roof, and there is a fear that this would discourage individuals from engaging a diversity of strategies to meet the target score.

SRI

Ms. Watkins continued her presentation by addressing some concerns that had been raised in the previous meeting about the incorporation of SRI into the Cool Factor. She reminded participants that points can be earned in the Cool Factor by high-SRI paving because light-colored paving is an effective cooling strategy that the City wants to incentivize.

Additionally, she addressed people’s concerns about the degradation of materials’ SRI scores with aging by clarifying that the SRI values on the Cool Factor are based on aged paving, which allows space for an expected degradation of materials.

Similar to Cool Roofs, there were concerns that individuals would be able to earn their full target score by only changing to high SRI paving and some suggested that there should be a cap on the amount of points that can be earned from high SRI paving. Ms. Watkins demonstrated that if the Cool Target is 15%, only a completely empty lot could meet the target with all high-SRI paving. Once buildings are added to lots, other strategies must be undertaken in order to achieve the Cool Target under the Cool Factor. As buildings get bigger, more strategies need to be employed to meet the Cool Target.

Questions and Answers: *Responses from City staff/project team are italicized.*

- Rewards for paving should be eliminated regardless of the color or the rewards should be capped, as the 0.15 multiplier allows for a 100% paved site in districts requiring only 15% open space.
 - *Our perspective is that it is important to give lighter paving more weight than dark paving, but we hear the perspective that we don’t want to make it too easy to meet the standard with paving alone.*

- If the ultimate goal of this initiative is to cool the City, it does not make sense to include a cap on the points one can earn for any tactic as long as they contribute to evidence-based cooling.
- Because different strategies are weighted differently, I cannot see any value to putting a cap on any strategy. This would limit flexibility.
- Would traditional red brick earn points?
 - *The SRI is too low on traditional red brick, but you could use a lighter-colored brick to earn the points.*
- What about pervious pavement, which evaporates moisture and temperature?
 - *The cooling benefit from pervious pavement is too marginal to justify earning any points from it for cooling. Again, it has other benefits we capture in stormwater management and other regulations.*
- Asphalt, an affordable paving option, gets lighter as it ages. Would this be accounted for in the Cool Factor scoring?
 - *Asphalt would not meet the SRI requirement unless it undergoes treatment to make it lighter, or if it was really old.*
- What about concrete paving?
 - *Yes, it would count as it has a high SRI value.*
- In spaces like Harvard Square, where there is almost no available open space for planting trees, and where green roofs would be impossible to install because of the slanted roofs that so many buildings have, it would be really difficult to incorporate enough strategies to meet the full Cool Target. So, limiting any strategy is not the appropriate approach in settings like Harvard Square.
- It's important to remember that the Cool Factor tries to account for the fact that different strategies have different cooling benefits. To me, reflective pavement is the least beneficial cooling effect that one could strive for when there are so many better ones, and so it has the lowest score.
 - *We had talked about how a baseline Cool Target could be 15%, which is based on Article 19 which has a 15% minimum open space requirement (unless it is higher for that particular zoning district). A higher Cool Target could be considered, at the last meeting there was concern that the target might be too low.*
- *QUESTION: Should there be a "cap" on points that can be earned through paving? Consensus generally no, alternatives could be recalibrating the scoring for high-SRI pavement or adjusting the Cool Target.*
- When thinking about constrained spaces, and spaces like campuses, I think an idea worth exploring is giving people the ability to transfer cooling rights, because in the end it would lead to a cooler Cambridge.

- There is research looking at urban density and tree canopy cover, that talks about how tree canopy cover needs to be spread out rather than concentrated in one space to get a more widespread cooling effect.

Solar Panels and Green Roofs

Kathy addressed the concerns about solar panels and green roofs competing for space by showing examples where both of these features were incorporated in a single roof and clarified that points would not be taken away from individuals for having solar panels in their roofs.

Questions and Answers: *Responses from City staff/project team are italicized.*

- Given the limited space available on any particular roof, there is a zero-sum game that makes the installation of solar panels and green roofs competing priorities for addressing climate change. This is especially true for lab buildings, where open roof space is so much more limited than in other areas.
 - *To clarify, you would get credit for the white roofs, even if solar panels are installed over them.*
- The solar panels actually shade the roof: is there some cooling benefit that comes from that?
 - Yes, the panels cool the roof itself but raise the ambient temperature around the solar panels themselves.
 - *We have looked at some of the literature on that, and there is no clear verdict on the heating or cooling effects of solar panels on roofs, unless the panels are iridescent. The Cool Factor was designed to be deliberately neutral on solar panels, so that installing them would not detract from a site's Cool Score.*

Trees

Kathy then addressed the questions that had been raised in the last meeting regarding trees. She clarified that the Cool Factor benefits the maintenance of existing large trees over the installation of new trees that are still growing, by giving the former more points than the latter.

Questions and Answers: *Responses from the City are italicized.*

- Is the cooling effect of an existing tree higher than the cooling effect of a new large tree?
 - *Yes, because typically, a tree that is introduced and still growing would not be the same size as an older tree.*
- What about the relocation of large trees?
 - *Transplanting a tree would not be the same as preserving a tree, given the risks associated with transporting and transplanting it (e.g., the transported tree loses some branches, etc.).*

- The Cool Factor will have credibility only if it's enforceable. Has there been thought about how to handle requirements? For example, would inspectors be hired to go out and look at trees?
 - *It's true that because the ability to monitor over time is limited, zoning is not always the best tool for setting standards around trees and planting and vegetation. We need to be mindful of enforceability, but we also continue to develop tools and procedures to account for this.*
- Would there be situations where a tree is in decline and where planting a new tree would be the most beneficial strategy?
 - *We would ensure that in those cases individuals would not get penalized for taking that kind of tree down.*
- What if a property owner was willing to plant trees on the street?
 - *The City is already making additional commitments to planting more trees in Cambridge. The focus of the cool factor is on increasing the role of the private parcel on cooling.*
- Just want to note that there is a lot of talk here about large projects, but many medium-sized residential projects have no space for anything besides a driveway. Also want to note that over 25% of housing units have been changed over the last 25 years, and 15% of the land has been changed, which are significant numbers.
 - *As discussed at a prior meeting, the vast majority of new construction on a total square-foot basis is taking the form of large-scale development, but the majority of existing development in Cambridge is still older, smaller buildings.*
 - Transfer of credits might be an interesting way to address issue of existing/new development.

Written Comments from Task Force Members: *Responses from City staff/project team are italicized.*

- We should change the name back to Green Factor to better demonstrate the wider benefits of green infrastructure and make sure the factor includes more co-benefits and actions.
- It's important to require all zoning districts to contribute equally to green infrastructure. The current method of scoring using open space percentage as the denominator rather than lot size makes it appear that projects in industrial districts are greener than those in other districts, when in fact this is not the case.
- Should we broaden the goal and make this focused on greening the city and not just cooling it? Thinking back to the conversation about green roofs, it does not appear that the cooling benefit of that would happen at grade, in a way that trees on the street have an immediately felt cooling benefit.

- *Green roofs do mitigate heat island effects and there is noticeable difference in temperature when one is walking by a building with a green roof; research shows that the ambient temperature on the ground at spots where there are green roofs tend to be lower than in other areas.*
- *The Cool Factor does reward strategies that happen at grade more than it rewards other tactics.*
- This framework will have to be calibrated to the scale of development density. There is a question of feasibility versus on-the-ground aspiration.
- I don't know if the Cool Factor should try to achieve too many things. It is worrisome to try to use one tool to achieve many different goals. It would also lead to the City spending more money and more resources.
 - *The alternative to doing this through specific zoning would be a more prescriptive approach that has less choices and flexibility than the Cool Factor approach. Overall in zoning, things are meant to transition from less conforming to more conforming over time as the building stock changes. The expectation is that standards are set as the "ideal," and things change to get us closer to that ideal.*

General Discussion on Cool Factor:

- *QUESTION: For determining "public space" benefit, should private streets count? Generally, consensus yes.*
- *Innovation credit – needs work on how to frame it.*
 - Would need to be vetted, possibly develop regulations
 - LEED (as an example) limits the number of innovation credits that can be earned
 - LEED also has "pilot credits" (JB) not a big risk people are going to get a lot of credits.
- *QUESTION: Should there be a requirement to meet some part of the credit through at-grade approaches?*
 - No – a tree at ground level gets more points than anything on the roof, it's up to the land owner how they reach the goal, that's the point of a points-based system.
 - With a small constrained site, would have to go up to the roof to earn points.
 - Do green roofs have same the same cooling quality as on the ground?
 - Consider what it is the goal is, lowering ambient temperature at some point vertically, or focused on experience at grade
 - What difference is a green roof at 30 feet if you can't tell? Studies show there is a difference at grade with green roofs – will provide those studies to look at.
- Does shade provided from a building count? *A building isn't considered a "shade structure" in this formulation.*

- *QUESTION: Idea was proposed of relating the Cool Target to the open space requirement (with baseline 15%), should it be this way or some other way? Same for all zones?*
 - We don't have enough of an understanding at this point, definitely the right question, going to have to calibrate.
 - Development patterns correlate to zoning districts. Areas that are less dense might have an easier time achieving higher Cool Scores than areas that are more dense.
 - What's the trigger for compliance? New construction is one thing, but for existing buildings that cover the whole lot, the conditions are different.
 - Certain areas need more help than others, focus strategies to incentivize improvement in those areas.
 - Most of the city has an urban heat problem, some areas are relatively hotter but other places are still hot.
 - Idea of transferring credits would have to take into account proximity.
 - City is dense already and dense areas are growing together, have to achieve something in dense areas and on main travel routes.
 - Inherent in all cities there are downtown areas without as many trees, further-out areas with smaller buildings and more open space, can't be a one-size-fits-all approach.
- *QUESTION: Overall, is this an idea the Task Force wants to continue pursuing? Would other approaches, like more prescriptive standards, be preferable?*
 - One of the more interesting, potentially useful things I've seen, might be improved down the road.
 - Part of the benefit is the simplicity, one set of scoring with higher scores for things that are desired. If version 1.0 isn't achieving some things, the system could evolve, there could be review and modification.
 - Temperatures will increase due to climate change, but urban heat island effect is due to the built environment, that's something we have some control over.

[Preview of Next Discussion: Incorporating Resilience Standards into Zoning](#)

Jeff Roberts gave a presentation to speak about various ways standards can be implemented through zoning (*see presentation for details*). There will be materials sent to Task Force members providing a basic the "menu of options" that can be considered when the Task Force considers zoning recommendations.

Public Comment

- I don't think that people should get credit for depaving lots in the same way that they can get credit for doing something actively about drainage.
- I think it would be a good idea to get all Cambridge residents involved in self-monitoring. You could set up an app where people are informed about what is supposed to be in place in certain buildings, and people could go and check on those things. A lot of these strategies could be monitored by volunteers.

The meeting was adjourned at 8:00 PM.